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AN 1998-242089 JAPIO
TI POLISHING END POINT DETECTING METHOD, POLISHING EQUIPMENT AND SEMICONDUCTOR DEVICE
IN YAMAMURO TAKASHI
PA MITSUBISHI ELECTRIC CORP, JP (CO 000601)
RYODEN SEMICONDUCTOR SYST ENG KK, JP (CO)
PI **JP 10242089** A 19980911 Heisei
AI JP1997-39317 (JP09039317 Heisei) 19970224
SO PATENT ABSTRACTS OF JAPAN (CD-ROM), Unexamined Applications, Vol. 98, No. 9
AB PURPOSE: TO BE SOLVED:To provide a polishing end point detecting method which easily and precisely detects the end point of polishing. CONSTITUTION: -difference is generated on a polysilazane film 33 and an insulating film 34 which are deposited in order and formed on a metal wiring 32, and flattening is necessary. For flattening, a wafer 3 is polished from the side of the insulating film 34, by using abrasive agent containing solvent having hydroxyl groups. When polishing is progressed, the surface of the wafer 13 is flattened, and the surface of the polysilazane film 34 is partly exposed at last. Then ammonia gas is generated by chemical reaction of the solvent and the polysilazane film 33. The generated ammonia gas is detected by a detector, and the gas generation is set as the reference for the end point of polishing.

DERWENT-ACC-NO: 1998-548297
DERWENT-WEEK: 199847

TITLE: Polish end point detection method for semiconductor wafer - involves indicating end point of polishing by generation of ammonia gas due to reaction of first film of processed object with predetermined solvent

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ABSTRACTED-PUB-NO: JP10242089A
BASIC-ABSTRACT:

The method involves making the first film (33) of a processed object (13) contact a predetermined solvent. Before establishing the contact, the first film which is formed in order with a second film (34), is exposed.

By the reaction of the first film with the solvent, ammonia gas is generated. The generation of ammonia gas is detected by a detector and understood as the standard of polishing end point.

USE - For semiconductor device manufacture.

ADVANTAGE - Avoids too much polishing. Detects gas generation reliably.

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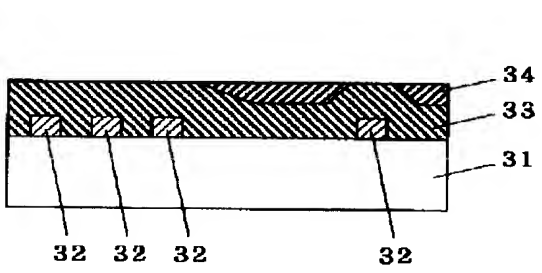
(54)【発明の名称】　研磨終点検知方法、研磨装置及び半導体装置

(57)【要約】

【課題】　容易かつ精度良く研磨の終点を検知する研磨終点検知方法を提供する。

【解決手段】　金属配線３２上に順に堆積されて形成された、層間絶縁膜となるポリシラザン膜３３及び絶縁膜３４には段差が生じており、平坦化が必要である。平坦化のために、ウェーハ１３を絶縁膜３４の側から、水酸基を有する溶剤を含む研磨剤を用いて研磨する。研磨の進行と共にウェーハ１３の表面は平坦化され、ついにはポリシラザン膜３４の表面が一部露出される。すると、溶剤とポリシラザン膜３３との化学反応によってアンモニアガス１８が発生する。アンモニアガス１８は検出器２２によってその発生を把握され、ガスの発生が研磨の終点の基準とされる。



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【特許請求の範囲】
【請求項１】　第１及び第２の膜を順に備え、該第１の膜を表面とする被加工体を準備し、
前記第２の膜と反応してガスを生成するガス生成物質を用いつつ前記第１の膜の研磨を行い、
前記ガスの生成をもって研磨の終点とする、研磨終点検知方法。
【請求項２】　請求項１に記載の研磨終点検知方法であって、
前記被加工体は、素子が集積された半導体基板上に前記第２及び第１の膜がこの順に積層された半導体装置であり、
前記第１の膜は絶縁膜であり、
前記第２の膜はポリシラザンを含み、
前記ガス生成物質は水酸基を有する、研磨終点検知方法。
【請求項３】　ガス発生物質を含む被研磨体が内部にて研磨される隔離容器と、
前記ガス発生物質からのガス発生を誘起する研磨剤を用いて前記被研磨体を研磨する研磨手段と、
前記ガス発生物質からのガスを検知する検知手段とを備える、研磨装置。
【請求項４】　請求項３に記載の研磨装置であって、
前記隔離容器は、キャリアガス用の給気口及び排気口を有し、
前記キャリアガスの流路に関し、前記研磨手段よりも下流側に前記検知手段が位置する、研磨装置。
【請求項５】　請求項４に記載の研磨装置であって、前記キャリアガスは不活性ガスである、研磨装置。
【請求項６】　表面に素子が集積されている基板と、
前記表面上に形成されている、絶縁性のガス発生膜と、
前記ガス発生膜上の絶縁膜とを備える、半導体装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、研磨終点検知方法、研磨装置及び半導体装置に関するものであり、特には半導体装置の表面の膜の研磨による平坦化に関する。
【０００２】
【従来の技術】半導体装置の分野では、デバイスの高機能化に伴い、パターンの微細化及び多層化が進んでいる。多層化する配線の加工技術においては、信頼性の高い配線を形成するために、層間絶縁膜の表面を平坦化せねばならない。平坦化された層間絶縁膜を得るための技術としては、例えば、各種ＣＶＤ技術、ＳＯＧ塗布法及びＣＶＤ技術とエッチング技術との組み合わせ、又はレジストエッチバック法等が利用されている。
【０００３】近年では、層間絶縁膜を化学的及び機械的に研磨して平坦化を行う化学機械研磨法（Ｃｈｅｍｉｃａｌ　Ｍｅｃｈａｎｉｃａｌ　Ｐｏｌｉｓｈｉｎｇ；以下、ＣＭＰ法と記す）が提案されている。ＣＭＰ法は、

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研磨剤中の溶剤のもたらす化学的溶解と、研磨剤中の研磨粒子の機械的磨耗とによって膜の表面を平坦化する方法である。このＣＭＰ法とはもともとシリコンウェーハ等の基板の研磨に適用されていた技術であり、この研磨技術が層間絶縁膜の表面の平坦化に転用されたものである。
【０００４】例えば金属配線等によって表面に凹凸を有するウェーハの表面上にＣＶＤ法等によって形成された層間絶縁膜の表面には、基板表面の凹凸に対応して凹凸が生じる。凹凸を有する層間絶縁膜の表面に対して研磨を行い、凸部又は凹部がなくなるまで平坦化を行う。
【０００５】
【発明が解決しようとする課題】ＣＭＰ法を用いる層間絶縁膜表面の平坦化においては、表面から凹凸がなくなった研磨の終了時点（以下、終点と記す）を決定する事は極めて難しい。終点の前に研磨を終了した場合には膜表面に凹凸が残存し、平坦化後の露光工程で悪影響が出る。また、研磨しすぎた際には例えば層間絶縁膜下の金属配線層が露出してしまい、層間絶縁膜上の配線層と短絡を起こすおそれがある。
【０００６】終点の従来の検知法は、研磨に要する基準の時間の分だけ研磨を行うというものであった。予め試験的にウェーハに備わる層間絶縁膜の研磨を行い、所望の研磨量を得るための時間を把握しておくというものである。
【０００７】しかし、この検知法では、終点時に層間絶縁膜の表面の平坦化が適度であるかどうかの再現性は低くなってしまい、これにともなって層間絶縁膜の表面の平坦化の精度が低くなるという問題点がある。また、試験的な研磨が必要であるため、これに時間を要するという問題点がある。更に、ウェーハに集積される素子のパターン毎に研磨に要する時間が異なり、パターン毎に終点を把握しなければならないという問題点があった。
【０００８】本発明は、以上の問題点に鑑み、容易かつ精度良く研磨の終点を検知する研磨終点検知方法及びこれに用いられる研磨装置及び半導体装置を提供することを目的とする。
【０００９】
【課題を解決するための手段】請求項１に記載の研磨終点検知方法は、第１及び第２の膜を順に備え、該第１の膜を表面とする被加工体を準備し、前記第２の膜と反応してガスを生成するガス生成物質を用いつつ前記第１の膜の研磨を行い、前記ガスの生成をもって研磨の終点とする。
【００１０】請求項２に記載の研磨終点検知方法は、請求項１に記載の研磨終点検知方法であって、前記被加工体は、素子が集積された半導体基板上に前記第２及び第１の膜がこの順に積層された半導体装置であり、前記第１の膜は絶縁膜であり、前記第２の膜はポリシラザンを含み、前記ガス生成物質は水酸基を有する。

【００１１】請求項３に記載の研磨装置は、ガス発生物質を含む被研磨体が内部にて研磨される隔離容器と、前記ガス発生物質からのガス発生を誘起する研磨剤を用いて前記被研磨体を研磨する研磨手段と、前記ガス発生物質からのガスを検知する検知手段とを備える。

【００１２】請求項４に記載の研磨装置は、請求項３に記載の研磨装置であって、前記隔離容器は、キャリアガス用の給気口及び排気口を有し、前記キャリアガスの流路に関し、前記研磨手段よりも下流側に前記検知手段が位置する。

【００１３】請求項５に記載の研磨装置は、請求項４に記載の研磨装置であって、前記キャリアガスは不活性ガスである。

【００１４】請求項６に記載の半導体装置は、表面に素子が集積されている基板と、前記表面上に形成されている、絶縁性のガス発生膜と、前記ガス発生膜上の絶縁膜とを備える。

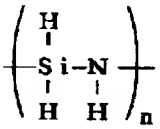
【００１５】

【発明の実施の形態】図１は、本実施の形態に従う層間絶縁膜の研磨装置１０の構造を例示する断面図である。研磨装置１０は、回転軸１５ａによって回転可能に支持されている円盤状の定盤１１を備える。定盤１１上には、粘着剤によって研磨布１２が貼り付けられている。回転軸１５ｂによって回転可能に支持されている、ウェーハ１３を研磨時に保持するヘッド１４は、定盤１１に対面する位置に設置されている。回転軸１５ａ，１５ｂの先には、図示を省略されている周知の駆動手段が接続されている。

【００１６】図２は、ウェーハ１３の構造を例示する断面図である。ウェーハ１３を構成するシリコン基板３１の表面には、集積された素子の一部である金属配線３２が形成されている。この金属配線３２を有するシリコン基板３１上に順に、ポリシラザン膜３３と、シリコン酸化膜等である絶縁膜３４とが堆積によって形成されている。ポリシラザン膜３３及び絶縁膜３４は、金属配線３２の絶縁のための層間絶縁膜となる。ポリシラザンとは、

【００１７】

【化１】



【００１８】で表される物質である。ポリシラザンはＯＨ基（水酸基）を有する物質と反応して、例えば

【００１９】

【化２】

$$\left(SiH_2-NH\right) + 2CH_3OH \rightarrow SiO_2 + NH_3 + 2CH_4$$

【００２０】のようにアンモニアを発生する。

【００２１】金属配線３２の厚みによって、金属配線３２上に形成されたポリシラザン膜３３及び絶縁膜３４には、凹凸又は段差が生じている。写真製版技術における露光工程を適切に行うためには、凹凸及び段差をなくし、ウェーハ１３の表面を研磨によって平坦にせねばならない。

【００２２】研磨を行う際にはまず、ウェーハ１３の表面のうち絶縁膜３４側が図１のヘッド１４の反対となるように、即ち凹凸のある側が研磨布１２側となるようにウェーハ１３の装着を行う。次に、ヘッド１４を定盤１１の向きへと押し下げることによって、絶縁膜３４を研磨布１２の表面に押しつける。

【００２３】図１に例示される定盤１１の上方には、水酸基を有する溶剤が含まれている研磨剤１６を供給するノズル１７が配置されている。このノズル１７から研磨剤１６を研磨布１２へと供給しつつ、定盤１１及びヘッド１４を回転軸１５ａ，１５ｂによってそれぞれ回転させる。研磨剤１６を含んだ研磨布１２との摩擦によって、図２に例示される絶縁膜３４は研磨される。

【００２４】絶縁膜３４の研磨が進行すると、図３に例示されるようにポリシラザン膜３３が露出される。図３は、ポリシラザン膜３３の表面の一部が露出されている状態を例示する断面図である。同図に示されるように、ポリシラザン膜３３が露出され始めた時点では、ポリシラザン膜３３及び絶縁膜３４にて構成されるウェーハ１３の表面は既に平坦化されている。ポリシラザン膜３３が部分的に露出されている状態にてポリシラザンと図１に例示される研磨布１２中の研磨剤１６とが反応し、アンモニアガス１８が発生する。

【００２５】研磨装置１０を構成するチャンバの隔壁１９によって、アンモニアガス１８は研磨装置１０の内部に閉じ込められる。隔壁１９には、アンモニアガス１８の流れに方向性を持たせて検出の感度を向上させるために、給気口２０及び排気口２１が設けられている。ウェーハ１３に関して下流側である排気口２１の途中には、検出器２２が取り付けられている。

【００２６】給気口２０から流し込まれるキャリアガスによって、ウェーハ１３から発生したアンモニアガス１８は隔壁１９内に滞留することなく速やかに検出器２２へと到達する。これによって、アンモニアガス１８の発生を速やかに検出器２２によって把握することが可能となり、後述の研磨の終点の判断を適切な時点で行うことが可能となる。

【００２７】キャリアガスとして不活性ガスを採用する場合には、アンモニアガス１８がキャリアガスとの反応によって消失するおそれがなくなる。更に、キャリアガスによって、隔壁１９の内部へと外気が侵入することが回避される。これらによって、アンモニアガス１８が発生したにも関わらず検出器２２が検出しそこねるおそ

れ、及び検出器２２によって外気中のアンモニアガスが検出されるおそれがなくなり、アンモニアガス１８の検出が精度良くかつ確実に行われる。

【００２８】検出器２２は、アンモニアガスを識別してその濃度を測定する濃度計である。検出器２２は、アンモニアガス１８に関する検出信号２３を制御部２４に入力する。制御部２４は、検出信号２３の入力に基づき研磨の終点を判断する。例えばアンモニアガス１８の濃度がある設定値以上になった時点を研磨の終点とすることによってこの判断をなし、終点を検知する。設定値以上のアンモニア濃度を判断の基準とすることによって、図２に例示されるポリシラザン膜３３が露出されていないのに研磨の終点であると誤判断されることを回避することが可能である。

【００２９】制御部２４は研磨の終点の判断に応じ、図示されない駆動手段を用いて回転軸１５ｂ及びヘッド１４を引き上げ、ウェーハ１３を研磨布１２から引き離す。これによってウェーハ１３に備わる、図３に例示される絶縁膜３４及びポリシラザン膜３３の研磨が終了し、ウェーハ１３は、絶縁膜３４及び絶縁性を有するポリシラザン膜３３によって構成される平坦な層間絶縁膜によって表面を覆われる。

【００３０】本発明の研磨の終点を検知する方法においては、ポリシラザンがそれぞれ有する絶縁性と、水酸基を含む溶剤と反応してアンモニアガスを発生するガス発生性とが有効に利用されて、研磨の終点の検知及び層間絶縁膜の獲得が行われる。例えば溶剤とのガス発生性はあっても絶縁性のない材料をポリシラザン膜３４の代わりに用いた場合には、研磨の終点の検知を行うことはできても、金属配線３２の絶縁を行う層間絶縁膜を得ることはできない。従って、ポリシラザンは、平坦化された層間絶縁膜が必要である半導体装置に関して非常に有用な材料であることが理解される。

【００３１】尚、上述の説明においてはポリシラザン膜３４が用いられたが、ポリシラザン以外の物質でも、研磨剤の溶剤として混入可能である物質と反応してガスを発生し、絶縁性を有するものならば使用することが可能である。

【００３２】本発明の研磨の終点の検知方法においては、ガスの発生の有無が検知の判断の基準となっており、容易かつ精度良く研磨の終点を把握することが可能である。また、個々のウェーハに対して精度良く平坦化を行えることから、複数のウェーハ間において層間絶縁膜の平坦化の度合いを揃えることが可能となっている。互いにウェーハの種類が異なる場合にも、ガスの発生と研磨の終点とが結び付けられているので、種類毎に予め研磨の終点を把握しておく必要もない。

【００３３】上述の研磨装置１０を用いることによって、本発明の研磨の終点の検知方法をガスの出入りのない状態にて好適に行うことが可能となる。また、従来のように試験的な研磨を行う必要がなくなり、迅速に層間絶縁膜の平坦化を行える。

【００３４】

【発明の効果】請求項１に記載の構成によれば、第１の膜の研磨が行われ第２の膜が露出された際に第２の膜とガス生成物質との反応によってガスが生成され、このガスの生成が研磨の終点の基準となっている。ガスの生成の有無は２極的な情報であり、複数の被加工体間において一定に第１の膜の研磨が行われる。これによって、複数の被加工体が均質に研磨される。

【００３５】請求項２に記載の構成によれば、集積された素子によって段差が生じている第１の膜を平坦化する際に、ポリシラザンを含む第２の膜によって請求項１に記載の効果が得られると同時に、ポリシラザンの絶縁性によって半導体装置の層間絶縁膜が第１及び第２の膜によって実現される。

【００３６】請求項３に記載の構成によれば、ガスが隔離容器の外部とは行き来しない状態にて研磨手段の動作時にガス発生物質からのガスが経時的に検知される。請求項３に記載の研磨装置内にて請求項１に記載の研磨終点検知方法を行う際には、外部からのガスによって誤判定を行うことなく研磨の終点を検知することが可能となる。

【００３７】請求項４に記載の構成によれば、キャリアガスの流れによって、隔離容器内のガスの変化を迅速に知ることが可能となる。これによって、ガス発生物質からのガスの発生が迅速に検知され、研磨の終点時から遅れることなく研磨の終点を把握し、研磨を終了することが可能となる。従って、過度の研磨が回避される。

【００３８】請求項５に記載の構成によれば、ガス発生物質から発生したガスはキャリアガスと反応しない。発生したガスは検知手段によって確実に検知され、請求項１に記載の研磨終点検知方法を行う場合には、研磨の終点を確実に検知することが可能となる。

【００３９】請求項６に記載の構成によって、請求項１に記載の研磨終点検知方法を実際に行うことが可能となる。

【図面の簡単な説明】

【図１】　本発明に従う層間絶縁膜の研磨装置の構造を例示する断面図である。

【図２】　本発明のウェーハの構造を例示する断面図である。

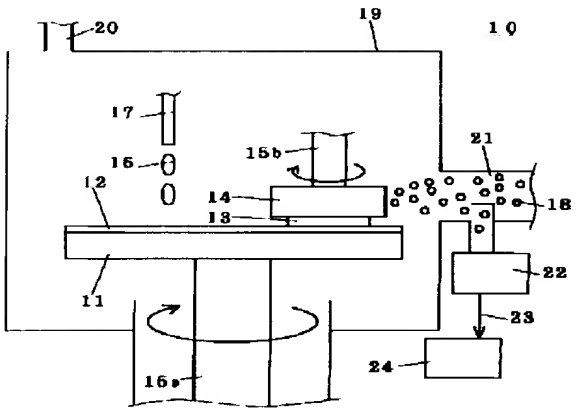
【図３】　図２に例示されるの構造の研磨後の構造を例示する断面図である。

【符号の説明】

１０　研磨装置、１１　定盤、１２　研磨布、１３　ウェーハ、１４　ヘッド、１５ａ，１５ｂ　回転軸、１６　研磨剤、１７　ノズル、１８　アンモニアガス、１９　隔壁、２０　給気口、２１　排気口、２２　検出器、２３　検出信号、２４　制御部、３１　シリコン基板、

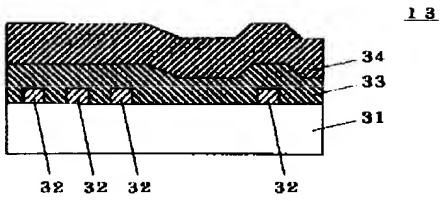
３２　金属配線、３３　ポリシラザン膜、３４　絶縁　　膜。

【図１】



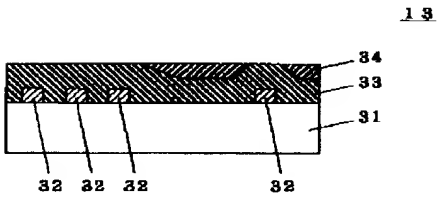
１０：研磨装置
１１：定盤
１２：研磨布
１３：ウェーハ
１４：ヘッド
１５ａ，１５ｂ：回転軸
１６：研磨剤
１７：ノズル
１８：アンモニア
１９：隔壁
２０：給気口
２１：排気口
２２：検出器
２３：検出信号
２４：制御部

【図２】



３１：シリコン基板
３２：金属配線
３３：ポリシラザン膜
３４：絶縁膜

【図３】



* NOTICES *

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1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated
3.In the drawings, any words are not translated.

CLAIMS

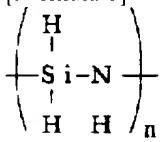
[Claim(s)]
[Claim 1] The polishing terminal-point detection technique which is equipped with the 1st and 2nd layers in order, prepares the worked object which uses this 1st layer as a front face, grinds the 1st aforementioned layer, using the quality of a gas product which reacts with the 2nd aforementioned layer and generates gas, and is made into the terminal point of polishing with generation of the aforementioned gas.
[Claim 2] It is the polishing terminal-point detection technique that are the polishing terminal-point detection technique according to claim 1, the aforementioned worked object is the semiconductor device with which the laminating of the above 2nd and the 1st layer was carried out to this order on the semiconductor substrate on which the element was accumulated, the 1st aforementioned layer is an insulator layer, and the aforementioned quality of a gas product has a hydroxyl group including polysilazane in the 2nd aforementioned layer.
[Claim 3] Polishing equipment equipped with the isolation container with which the ground field containing the gassing matter is ground inside, a polishing means to grind the aforementioned ground field using the abrasive material which carries out the induction of the gassing from the aforementioned gassing matter, and a detection means to detect the gas from the aforementioned gassing matter.
[Claim 4] It is the polishing equipment with which it is polishing equipment according to claim 3, and the aforementioned isolation container has the air supplying opening and exhaust port for carrier gas, and the aforementioned detection means is located in a lower-stream-of-a-river side rather than the aforementioned polishing means about the passage of the aforementioned carrier gas.
[Claim 5] It is the polishing equipment whose aforementioned carrier gas it is polishing equipment according to claim 4, and is inert gas.
[Claim 6] A semiconductor device equipped with the substrate by which the element is accumulated on the front face, the insulating gassing layer currently formed on the aforementioned front face, and the insulator layer on the aforementioned gassing layer.

[Translation done.]

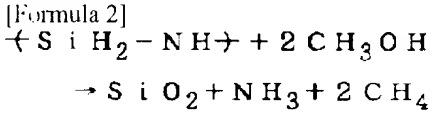
DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] this invention relates to the flattening by polishing of the layer of the front face of ********** especially about the polishing terminal-point detection technique, polishing equipment, and a semiconductor device.
[0002]
[Description of the Prior Art] In the field of the semiconductor device, detailed-izing and multilayering of a pattern are progressing in connection with highly-efficient-izing of a device. In the manipulation technique of the wiring to multilayer, in order to form a reliable wiring, you have to carry out the flattening of the front face of a layer insulation layer. As technique for obtaining the layer insulation layer by which the flattening was carried out, the combination of various CVD techniques, the SOG applying method and CVD technique, and etching technique or the resist etchback method is used, for example.
[0003] In recent years, the method [grind / chemical machinery] (it is described as the CMP method below Chemical Mechanical Polishing;) for grinding a layer insulation layer chemically and mechanically, and performing a flattening is proposed. The CMP method is the technique of carrying out the flattening of the membranous front face by the chemical lysis which the solvent in an abrasive material brings, and mechanical wear of the polishing grain in an abrasive material. This CMP method is the technique applied to polishing of substrates, such as a silicon wafer, from the first, and this polishing technique is diverted to the flattening of the front face of a layer insulation layer.
[0004] For example, in the front face of the layer insulation layer formed of CVD etc. on the front face of the wafer which has irregularity on a front face, irregularity arises with a metal wiring etc. corresponding to the irregularity on the front face of a substrate. It grinds to the front face of the layer insulation layer which has irregularity, and a flattening is performed until a heights or a concavity is lost.
[0005]
[Problem(s) to be Solved by the Invention] In the flattening of the layer insulation layer front face using the CMP method, it is very difficult to determine the end time (for it to be hereafter described as a terminal point) of the polishing whose irregularity was lost from the front face. When polishing is ended in front of a terminal point, irregularity remains on a layer front face, and a bad influence comes out at the exposure process after a flattening. Moreover, when grinding too much, the metal wiring layer for example, under a layer insulation layer is exposed, and there is a possibility of causing the wiring layer and shunt on a layer insulation layer.
[0006] In the conventional method of detecting terminal, only the part of the time of the criteria which polishing takes ground. The time for grinding the layer insulation layer with which a wafer is equipped in a tentative way beforehand, and obtaining the desired amount of polishing is grasped
[0007] However, by this detecting method, the trouble where become low and the precision of the flattening of the front face of a layer insulation layer becomes low in connection with this has the repeatability with the moderate flattening of the front face of a layer insulation layer at the time of a terminal point. Moreover, since experimental polishing is required, there is a trouble where this takes time. Furthermore, the time which polishing takes for every pattern of the element accumulated by the wafer differed, and there was a trouble where a terminal point had to be grasped for every pattern.
[0008] this invention aims at offering the polishing equipment and the semiconductor device which are used for the polishing terminal-point detection technique and this which detect the terminal point of polishing with an easily and sufficient precision in view of the above trouble.
[0009]
[Means for Solving the Problem] The polishing terminal-point detection technique according to claim 1 is equipped with the 1st and 2nd layers in order, prepares the worked object which uses this 1st layer as a front face, it grinds the 1st aforementioned layer, the quality of a gas product which reacts with the 2nd aforementioned layer and generates gas being used for it, and makes it the terminal point of polishing with generation of the aforementioned gas.
[0010] The polishing terminal-point detection technique according to claim 2 is the polishing terminal-point detection technique according to claim 1, the aforementioned worked object is the semiconductor device with which the laminating of the above 2nd and the 1st layer was carried out to this order on the semiconductor substrate on which the element was accumulated, the 1st aforementioned layer is an insulator layer and, in the 2nd aforementioned layer, the aforementioned quality of a gas product has a

hydroxyl group including polysilazane.
[0011] Polishing equipment according to claim 3 is equipped with the isolation container with which the ground field containing the gassing matter is ground inside, a polishing means to grind the aforementioned ground field using the abrasive material which carries out the induction of the gassing from the aforementioned gassing matter, and a detection means to detect the gas from the aforementioned gassing matter.
[0012] Polishing equipment according to claim 4 is polishing equipment according to claim 3, the aforementioned isolation container has the air supplying opening and exhaust port for carrier gas, and the aforementioned detection means is located in a lower-stream-of-a-river side rather than the aforementioned polishing means about the passage of the aforementioned carrier gas.
[0013] Polishing equipment according to claim 5 is polishing equipment according to claim 4, and the aforementioned carrier gas is inert gas.
[0014] A semiconductor device according to claim 6 is equipped with the substrate by which the element is accumulated on the front face, the insulating gassing layer currently formed on the aforementioned front face, and the insulator layer on the aforementioned gassing layer.
[0015]
[Embodiments of the Invention] Drawing 1 is a cross section which illustrates the structure of the polishing equipment 10 of a layer insulation layer of following the gestalt of this operation. The polishing equipment 10 is equipped with the surface plate 11 of the shape of a disk currently supported by rotation-axis 15a possible [rotation]. The abrasive cloth 12 is stuck by the binder on the surface plate 11. The head 14 which is supported by rotation-axis 15b possible [rotation] and which holds a wafer 13 at the time of polishing is installed in the position which meets a surface plate 11. The drive means of the common knowledge which is having illustration omitted is connected to the point of axes 15a and 15b.
[0016] Drawing 2 is a cross section which illustrates the structure of a wafer 13. The metal wiring 32 which is a part of accumulated element is formed in the front face of the silicon substrate 31 which constitutes a wafer 13. In order, the polysilazane layer 33 and the insulator layer 34 which is a silicon oxide etc. are formed of deposition on the silicon substrate 31 which has this metal wiring 32. The polysilazane layer 33 and the insulator layer 34 turn into the layer insulation layer for an insulation of the metal wiring 32. Polysilazane is [0017].
[Formula 1]



[0018] It is the matter come out of and expressed. It reacts with the matter which has OH base (hydroxyl group), for example, polysilazane is [0019].
[Formula 2]



[0020] ** -- ammonia is generated like
[0021] With the thickness of the metal wiring 32, irregularity or the level difference has arisen in the polysilazane layer 33 and the insulator layer 34 which were formed on the metal wiring 32. In order to perform the exposure process in photoengraving-process technique pertinently, irregularity and a level difference must be lost and the front face of a wafer 13 must be made flat by polishing.
[0022] In case it grinds, an insulator layer 34 side equips with a wafer 13 among the front faces of a wafer 13 first so that the head 14 side which is irregular so that it may become opposite of drawing 1 may become an abrasive-cloth 12 side. Next, an insulator layer 34 is pushed against the front face of an abrasive cloth 12 by depressing a head 14 to the sense of a surface plate 11.
[0023] The nozzle 17 which supplies the abrasive material 16 in which the solvent which has a hydroxyl group is contained to the upper part of the surface plate 11 illustrated in drawing 1 is arranged. The surface plate 11 and the head 14 are rotated by axes 15a and 15b, respectively, supplying an abrasive material 16 to an abrasive cloth 12 from this nozzle 17. The insulator layer 34 illustrated in drawing 2 is ground by the friction with the abrasive cloth 12 containing the abrasive material 16.
[0024] Advance of polishing of an insulator layer 34 exposes the polysilazane layer 33 so that it may be illustrated in drawing 3. Drawing 3 is a cross section which illustrates the status that a part of front face of the polysilazane layer 33 is exposed. As shown in this drawing, when the polysilazane layer 33 begins to be exposed, the flattening of the front face of the wafer 13 which consists of a polysilazane layer 33 and an insulator layer 34 has already been carried out. The abrasive material 16 in the abrasive cloth 12 illustrated in the status that the polysilazane layer 33 is exposed partially in polysilazane and the drawing 1 reacts, and ammonia gas 18 occurs.
[0025] Ammonia gas 18 is confined in the interior of the polishing equipment 10 by the septum 19 of the chamber which constitutes the polishing equipment 10. In order to give a directivity to flowing of ammonia gas 18 and to raise the photographic sensitivity of a detection, the air supplying opening 20 and the exhaust port 21 are formed in the septum 19. In the middle of the exhaust port 21 which is a lower-stream-of-a-river side, the detector 22 is attached about the wafer 13.

[0026] By the carrier gas slushed from an air supplying opening 20, the ammonia gas 18 which occurred from the wafer 13 reaches to a detector 22 quickly, without piling up in a septum 19. By this, it is enabled to grasp occurrence of ammonia gas 18 with a detector 22 quickly, and is enabled to judge the terminal point of the below-mentioned polishing at the suitable time.
[0027] In adopting inert gas as carrier gas, a possibility that ammonia gas 18 may disappear by the reaction with carrier gas disappears. Furthermore, it is avoided by carrier gas that the open air trespasses upon the interior of a septum 19. Although ammonia gas 18 occurred, a possibility which a detector 22 cannot detect that it may be afraid and the ammonia gas in the open air may be detected by the detector 22 disappears, and a detection of ammonia gas 18 is ensured [often / precision / and] by these.
[0028] A detector 22 is a concentration meter who discriminates ammonia gas and measures the concentration. A detector 22 inputs the detecting signal 23 about ammonia gas 18 into a control section 24. A control section 24 judges the terminal point of polishing based on the input of a detecting signal 23. For example, nothing and a terminal point are detected for this decision by making the time of becoming more than the set point with the concentration of ammonia gas 18 into the terminal point of polishing. By considering as the criteria of decision of the ammonia concentration more than the set point, it is possible to avoid what will be incorrect-judged if it is the terminal point of polishing, although the polysilazane layer 33 illustrated in drawing 2 is not exposed.
[0029] A control section 24 pulls up rotation-axis 15b and the head 14 using the drive means which is not illustrated according to decision of the terminal point of polishing, and pulls apart a wafer 13 from an abrasive cloth 12. Polishing of the insulator layer 34 with which a wafer 13 is equipped by this and which is illustrated in drawing 3 , and the polysilazane layer 33 is completed, and a wafer 13 has a front face worn by the flat layer insulation layer constituted with the polysilazane layer 33 which has the insulator layer 34 and insulation.
[0030] In the technique of detecting the terminal point of polishing of this invention, the insulation which polysilazane has, respectively, and the gassing nature which reacts with the solvent containing a hydroxyl group and generates ammonia gas are used effectively, and detection of the terminal point of polishing and an acquisition of a layer insulation layer are performed. For example, even if there was gassing nature with a solvent, when the material without insulation is used instead of the polysilazane layer 34, even if the terminal point of polishing is detectable, it cannot obtain the layer insulation layer with which the metal wiring 32 is insulated. Therefore, it is understood about the semiconductor device with the layer insulation layer required for polysilazane by which the flattening was carried out that it is a very useful material.
[0031] In addition, it is possible to use it, if matter other than polysilazane also reacts with the matter mixable as a solvent of an abrasive material, gas is generated and it has insulation, although the polysilazane layer 34 is used in an above-mentioned explanation.
[0032] In the detection technique of the terminal point polishing of this invention, it is possible for the existence of occurrence of gas to have been the criteria of decision of detection, and to grasp the terminal point of polishing with an easily and sufficient precision. Moreover, it is possible to arrange the degree of the flattening of a layer insulation layer among two or more wafers from the ability to perform a flattening with a sufficient precision to each wafer. Since occurrence of gas and the terminal point of polishing are connected when the modalities of wafer differ mutually, it is not necessary to grasp the terminal point of polishing beforehand for every modality.
[0033] By using the above-mentioned polishing equipment 10, it is enabled to perform suitably the detection technique of the terminal point polishing of this invention in the status that there are no receipts and payments of gas. Moreover, it becomes unnecessary to carry out experimental polishing like before, and the flattening of a layer insulation layer can be performed quickly.
[0034]
[Effect of the Invention] When according to the configuration according to claim 1 polishing of the 1st layer is performed and the 2nd layer is exposed, gas is generated by the reaction of the 2nd layer and the quality of a gas product, and generation of this gas has been the criteria of the terminal point of polishing by it. The existence of generation of gas is 2 pole-information and polishing of the 1st layer is uniformly performed among two or more worked objects Two or more worked objects are homogeneously ground by this.
[0035] The layer insulation layer of a semiconductor device is realized by the insulation of polysilazane with the 1st and 2nd layers at the same time an effect according to claim 1 is acquired with the 2nd layer containing polysilazane, in case the flattening of the 1st layer which the level difference has produced by the accumulated element is carried out according to the configuration according to claim 2.
[0036] According to the configuration according to claim 3, the gas from the gassing matter is detected with time in the status that gas does not keep company with the exterior of an isolation container, at the time of an operation of a polishing means. In case the polishing terminal-point detection technique according to claim 1 is performed within polishing equipment according to claim 3, it is enabled to detect the terminal point of polishing, without performing an incorrect judging by the gas from the exterior.
[0037] According to the configuration according to claim 4, it is enabled to get to know change of the gas in an isolation container quickly by flowing of carrier gas. The terminal point of polishing is grasped, without occurrence of the gas from the gassing matter being quickly detected by this, and being late for the time of the terminal point of polishing with this, and it is enabled to end polishing. Therefore, too much polishing is avoided.
[0038] According to the configuration according to claim 5, the gas which occurred from the gassing matter does not react with carrier gas. The gas which occurred becomes possible [detecting the terminal point of polishing certainly], when it is certainly

detected by the detection means and it performs the polishing terminal-point detection technique according to claim 1 by it.
[0039] By the configuration according to claim 6, it is enabled to actually perform the polishing terminal-point detection technique according to claim 1.

[Translation done.]

* NOTICES *

Field

[The technical field to which invention belongs] this invention relates to the flattening by polishing of the layer of the front face of ********** especially about the polishing terminal-point detection technique, polishing equipment, and a semiconductor device.

[Translation done.]

* NOTICES *

Effect

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[0036] According to the configuration according to claim 3, the gas from the gassing matter is detected with time in the status that gas does not keep company with the exterior of an isolation container, at the time of an operation of a polishing means. In case the polishing terminal-point detection technique according to claim 1 is performed within polishing equipment according to claim 3, it is enabled to detect the terminal point of polishing, without performing an incorrect judging by the gas from the exterior.

[0037] According to the configuration according to claim 4, it is enabled to get to know change of the gas in an isolation container quickly by flowing of carrier gas. The terminal point of polishing is grasped, without occurrence of the gas from the gassing matter being quickly detected by this, and being late for the time of the terminal point of polishing with this, and it is enabled to end polishing. Therefore, too much polishing is avoided.

[0038] According to the configuration according to claim 5, the gas which occurred from the gassing matter does not react with carrier gas. The gas which occurred becomes possible [detecting the terminal point of polishing certainly], when it is certainly detected by the detection means and it performs the polishing terminal-point detection technique according to claim 1 by it.

[0039] By the configuration according to claim 6, it is enabled to actually perform the polishing terminal-point detection technique according to claim 1.

[Translation done.]

* NOTICES *

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention] In the flattening of the layer insulation layer front face using the CMP method, it is very difficult to determine the end time (for it to be hereafter described as a terminal point) of the polishing whose irregularity was lost from the front face. When polishing is ended in front of a terminal point, irregularity remains on a layer front face, and a bad influence comes out at the exposure process after a flattening. Moreover, when grinding too much, the metal wiring layer for example, under a layer insulation layer is exposed, and there is a possibility of causing the wiring layer and shunt on a layer insulation layer.

[0006] In the conventional method of detecting terminal, only the part of the time of the criteria which polishing takes ground. The time for grinding the layer insulation layer with which a wafer is equipped in a tentative way beforehand, and obtaining the desired amount of polishing is grasped.

[0007] However, by this detecting method, the trouble where become low and the precision of the flattening of the front face of a layer insulation layer becomes low in connection with this has the repeatability with the moderate flattening of the front face of a layer insulation layer at the time of a terminal point. Moreover, since experimental polishing is required, there is a trouble where this takes time. Furthermore, the time which polishing takes for every pattern of the element accumulated by the wafer differed, and there was a trouble where a terminal point had to be grasped for every pattern.

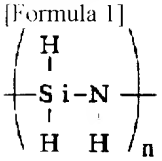
[0008] this invention aims at offering the polishing equipment and the semiconductor device which are used for the polishing terminal-point detection technique and this which detect the terminal point of polishing with an easily and sufficient precision in view of the above trouble.

[Translation done.]

* NOTICES *

MEANS

[Means for Solving the Problem] The polishing terminal-point detection technique according to claim 1 is equipped with the 1st and 2nd layers in order, prepares the worked object which uses this 1st layer as a front face, it grinds the 1st aforementioned layer, the quality of a gas product which reacts with the 2nd aforementioned layer and generates gas being used for it, and makes it the terminal point of polishing with generation of the aforementioned gas.
[0010] The polishing terminal-point detection technique according to claim 2 is the polishing terminal-point detection technique according to claim 1, the aforementioned worked object is the semiconductor device with which the laminating of the above 2nd and the 1st layer was carried out to this order on the semiconductor substrate on which the element was accumulated, the 1st aforementioned layer is an insulator layer and, in the 2nd aforementioned layer, the aforementioned quality of a gas product has a hydroxyl group including polysilazane
[0011] Polishing equipment according to claim 3 is equipped with the isolation container with which the ground field containing the gassing matter is ground inside, a polishing means to grind the aforementioned ground field using the abrasive material which carries out the induction of the gassing from the aforementioned gassing matter, and a detection means to detect the gas from the aforementioned gassing matter.
[0012] Polishing equipment according to claim 4 is polishing equipment according to claim 3, the aforementioned isolation container has the air supplying opening and exhaust port for carrier gas, and the aforementioned detection means is located in a lower-stream-of-a-river side rather than the aforementioned polishing means about the passage of the aforementioned carrier gas.
[0013] Polishing equipment according to claim 5 is polishing equipment according to claim 4, and the aforementioned carrier gas is inert gas
[0014] A semiconductor device according to claim 6 is equipped with the substrate by which the element is accumulated on the front face, the insulating gassing layer currently formed on the aforementioned front face, and the insulator layer on the aforementioned gassing layer.
[0015]
[Embodiments of the Invention] Drawing 1 is a cross section which illustrates the structure of the polishing equipment 10 of a layer insulation layer of following the gestalt of this operation. The polishing equipment 10 is equipped with the surface plate 11 of the shape of a disk currently supported by rotation-axis 15a possible [rotation]. The abrasive cloth 12 is stuck by the binder on the surface plate 11. The head 14 which is supported by rotation-axis 15b possible [rotation] and which holds a wafer 13 at the time of polishing is installed in the position which meets a surface plate 11. The drive means of the common knowledge which is having illustration omitted is connected to the point of axes 15a and 15b
[0016] Drawing 2 is a cross section which illustrates the structure of a wafer 13. The metal wiring 32 which is a part of accumulated element is formed in the front face of the silicon substrate 31 which constitutes a wafer 13. In order, the polysilazane layer 33 and the insulator layer 34 which is a silicon oxide etc are formed of deposition on the silicon substrate 31 which has this metal wiring 32. The polysilazane layer 33 and the insulator layer 34 turn into the layer insulation layer for an insulation of the metal wiring 32. Polysilazane is [0017].
[Formula 1]



[0018] It is the matter come out of and expressed. It reacts with the matter which has OH base (hydroxyl group), for example, polysilazane is [0019].
[Formula 2]

$$\{SiH_2-NH\}+2CH_3OH \rightarrow SiO_2+NH_3+2CH_4$$

[0020] ** -- ammonia is generated like
[0021] With the thickness of the metal wiring 32, irregularity or the level difference has arisen in the polysilazane layer 33 and the

insulator layer 34 which were formed on the metal wiring 32. In order to perform the exposure process in photoengraving-process technique pertinently, irregularity and a level difference must be lost and the front face of a wafer 13 must be made flat by polishing.

[0022] In case it grinds, an insulator layer 34 side equips with a wafer 13 among the front faces of a wafer 13 first so that the head 14 side which is irregular so that it may become opposite of drawing 1 may become an abrasive-cloth 12 side. Next, an insulator layer 34 is pushed against the front face of an abrasive cloth 12 by depressing a head 14 to the sense of a surface plate 11.

[0023] The nozzle 17 which supplies the abrasive material 16 in which the solvent which has a hydroxyl group is contained to the upper part of the surface plate 11 illustrated in drawing 1 is arranged. The surface plate 11 and the head 14 are rotated by axes 15a and 15b, respectively, supplying an abrasive material 16 to an abrasive cloth 12 from this nozzle 17. The insulator layer 34 illustrated in drawing 2 is ground by the friction with the abrasive cloth 12 containing the abrasive material 16.

[0024] Advance of polishing of an insulator layer 34 exposes the polysilazane layer 33 so that it may be illustrated in drawing 3 . Drawing 3 is a cross section which illustrates the status that a part of front face of the polysilazane layer 33 is exposed. As shown in this drawing, when the polysilazane layer 33 begins to be exposed, the flattening of the front face of the wafer 13 which consists of a polysilazane layer 33 and an insulator layer 34 has already been carried out. The abrasive material 16 in the abrasive cloth 12 illustrated in the status that the polysilazane layer 33 is exposed partially in polysilazane and the drawing 1 reacts, and ammonia gas 18 occurs.

[0025] Ammonia gas 18 is confined in the interior of the polishing equipment 10 by the septum 19 of the chamber which constitutes the polishing equipment 10. In order to give a directivity to flowing of ammonia gas 18 and to raise the photographic sensitivity of a detection, the air supplying opening 20 and the exhaust port 21 are formed in the septum 19. In the middle of the exhaust port 21 which is a lower-stream-of-a-river side, the detector 22 is attached about the wafer 13.

[0026] By the carrier gas slushed from an air supplying opening 20, the ammonia gas 18 which occurred from the wafer 13 reaches to a detector 22 quickly, without piling up in a septum 19. By this, it is enabled to grasp occurrence of ammonia gas 18 with a detector 22 quickly, and is enabled to judge the terminal point of the below-mentioned polishing at the suitable time.

[0027] In adopting inert gas as carrier gas, a possibility that ammonia gas 18 may disappear by the reaction with carrier gas disappears. Furthermore, it is avoided by carrier gas that the open air trespasses upon the interior of a septum 19. Although ammonia gas 18 occurred, a possibility which a detector 22 cannot detect that it may be afraid and the ammonia gas in the open air may be detected by the detector 22 disappears, and a detection of ammonia gas 18 is ensured [often / precision / and] by these.

[0028] A detector 22 is a concentration meter who discriminates ammonia gas and measures the concentration. A detector 22 inputs the detecting signal 23 about ammonia gas 18 into a control section 24. A control section 24 judges the terminal point of polishing based on the input of a detecting signal 23. For example, nothing and a terminal point are detected for this decision by making the time of becoming more than the set point with the concentration of ammonia gas 18 into the terminal point of polishing. By considering as the criteria of decision of the ammonia concentration more than the set point, it is possible to avoid what will be incorrect-judged if it is the terminal point of polishing, although the polysilazane layer 33 illustrated in drawing 2 is not exposed.

[0029] A control section 24 pulls up rotation-axis 15b and the head 14 using the drive means which is not illustrated according to decision of the terminal point of polishing, and pulls apart a wafer 13 from an abrasive cloth 12. Polishing of the insulator layer 34 with which a wafer 13 is equipped by this and which is illustrated in drawing 3 , and the polysilazane layer 33 is completed, and a wafer 13 has a front face worn by the flat layer insulation layer constituted with the polysilazane layer 33 which has the insulator layer 34 and insulation.

[0030] In the technique of detecting the terminal point of polishing of this invention, the insulation which polysilazane has, respectively, and the gassing nature which reacts with the solvent containing a hydroxyl group and generates ammonia gas are used effectively, and detection of the terminal point of polishing and an acquisition of a layer insulation layer are performed. For example, even if there was gassing nature with a solvent, when the material without insulation is used instead of the polysilazane layer 34, even if the terminal point of polishing is detectable, it cannot obtain the layer insulation layer with which the metal wiring 32 is insulated. Therefore, it is understood about the semiconductor device with the layer insulation layer required for polysilazane by which the flattening was carried out that it is a very useful material.

[0031] In addition, it is possible to use it, if matter other than polysilazane also reacts with the matter mixable as a solvent of an abrasive material, gas is generated and it has insulation, although the polysilazane layer 34 is used in an above-mentioned explanation.

[0032] In the detection technique of the terminal point polishing of this invention, it is possible for the existence of occurrence of gas to have been the criteria of decision of detection, and to grasp the terminal point of polishing with an easily and sufficient precision. Moreover, it is possible to arrange the degree of the flattening of a layer insulation layer among two or more wafers from the ability to perform a flattening with a sufficient precision to each wafer. Since occurrence of gas and the terminal point of polishing are connected when the modalities of wafer differ mutually, it is not necessary to grasp the terminal point of polishing beforehand for every modality.

[0033] By using the above-mentioned polishing equipment 10, it is enabled to perform suitably the detection technique of the terminal point polishing of this invention in the status that there are no receipts and payments of gas. Moreover, it becomes unnecessary to carry out experimental polishing like before, and the flattening of a layer insulation layer can be performed quickly.

* NOTICES *

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the cross section which illustrates the structure of the polishing equipment of a layer insulation layer of following this invention.
[Drawing 2] It is the cross section which illustrates the structure of the wafer of this invention.
[Drawing 3] It is the cross section which illustrates the structure after polishing of illustrating [in drawing 2] structure.
[Description of Notations]
10 Polishing equipment, 11 control section, 31 silicon substrate, 32 metal wiring, 33 polysilazane layer, 34 insulator layer. A surface plate, 12 An abrasive cloth. 13 A wafer, 14 A head, 15a, 15b A rotation axis, 16 An abrasive material, 17 A nozzle. 18 Ammonia gas, 19 A septum, 20 An air supplying opening, 21 An exhaust port, 22 A detector, 23 A detecting signal, 24

[Translation done.]